MINERAL INFORMATION INSTITUTE
An Affiliate of the SME Foundation

Our Basic Needs—What do you think?

Everything We Have and Everything We Use Comes From Our Natural Resources

Everything we have and everything we use has to come from somewhere. Help your students look closely at everything around them and learn where things come from. Remembering the Law of the Conservation of Matter* will help them truly understand the saying—

"If it can't be grown, it has to be mined."

• *The Law of Conservation of Matter*—Matter can be neither created nor destroyed. It also means you cannot make something out of nothing — therefore, *Everything Is Made From Something.*

FOOD

Where does the food you eat come from?

- What do you think it would be like to live on a farm?
- Is it easy to be a farmer? What would you grow?
- What do you think it was like to be a farmer a long time ago?

CLOTHING

What do you think clothes are made of?

- Do all clothes have labels? What do they say?
- How are your clothes like another classmate's? How are they different?
- What would you do to make your clothes better, easier to wear, last longer, look nicer?

SHELTER

What do you think your house is made of?

- Where did the materials come from?
- Is there a factory where you live that makes materials used to build your house?
- If you were building a house, what would you do first?

Play a game of **20 Questions**—where students find objects in the classroom, while other students ask questions to try to identify the origin of the object. Then classify each item into one of the three categories of Animal, Vegetable, Mineral.

Assign an object (or one of the metals or minerals) to each student to research. From what raw materials is it made? What properties and characteristics does the metal or mineral have that makes it suitable for use in that product? Do you think there is a substitute for the mineral used? Why, and where does it come from?

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Materials Standards Compliance
Everything We Use Comes From Natural Resources
Grade Level: K-4

Food, Clothing, Shelter
Type: Lessons & Activities
Science K-4.A (Science as Inquiry)
Science K-4.C (Life Science)
Science K-4.D (Earth and Space)
Science K-4.E (Science and Technology)

Where Do Things Come From?
Type: Lessons & Activities
Science K-4.A (Science as Inquiry)
Science K-4.B (Physical Science)
Science K-4.D (Earth and Space)
Science K-4.E (Science and Technology)

Turn on a Light
Type: Lessons & Activities
Science K-4.A (Science as Inquiry)
Science K-4.B (Physical Science)
Science K-4.D (Earth and Space)
Science K-4.F (Personal and Social)

Natural Resources and Your Christmas Tree
Type: Lessons & Activities
Science K-4.A (Science as Inquiry)
Science K-4.D (Earth and Space)
Science K-4.E (Science and Technology)
Science K-4.F (Personal and Social)

Make Your Own Paper Model of a Volcano
Type: Lessons & Activities
Science K-4.A (Science as Inquiry)
Science K-4.D (Earth and Space)

Materials Standards Compliance
Everything We Use Comes From Natural Resources
Grade Level: 5-8

Everything We Have and Everything We Use . . .
Type: Lessons & Activities
Science 5-8.A (Science as Inquiry)
Science 5-8.D (Earth and Space)
Science 5-8.F (Personal and Social)

Where Do Things Come From
Type: Lessons & Activities
Science 5-8.B (Physical Science)
Science 5-8.D (Earth and Space)
Science 5-8.E (Science and Technology)

Turn on a Light
Type: Lessons & Activities
Science 5-8.A (Science as Inquiry)
Science 5-8.B (Physical Science)
Science 5-8.F (Personal and Social)

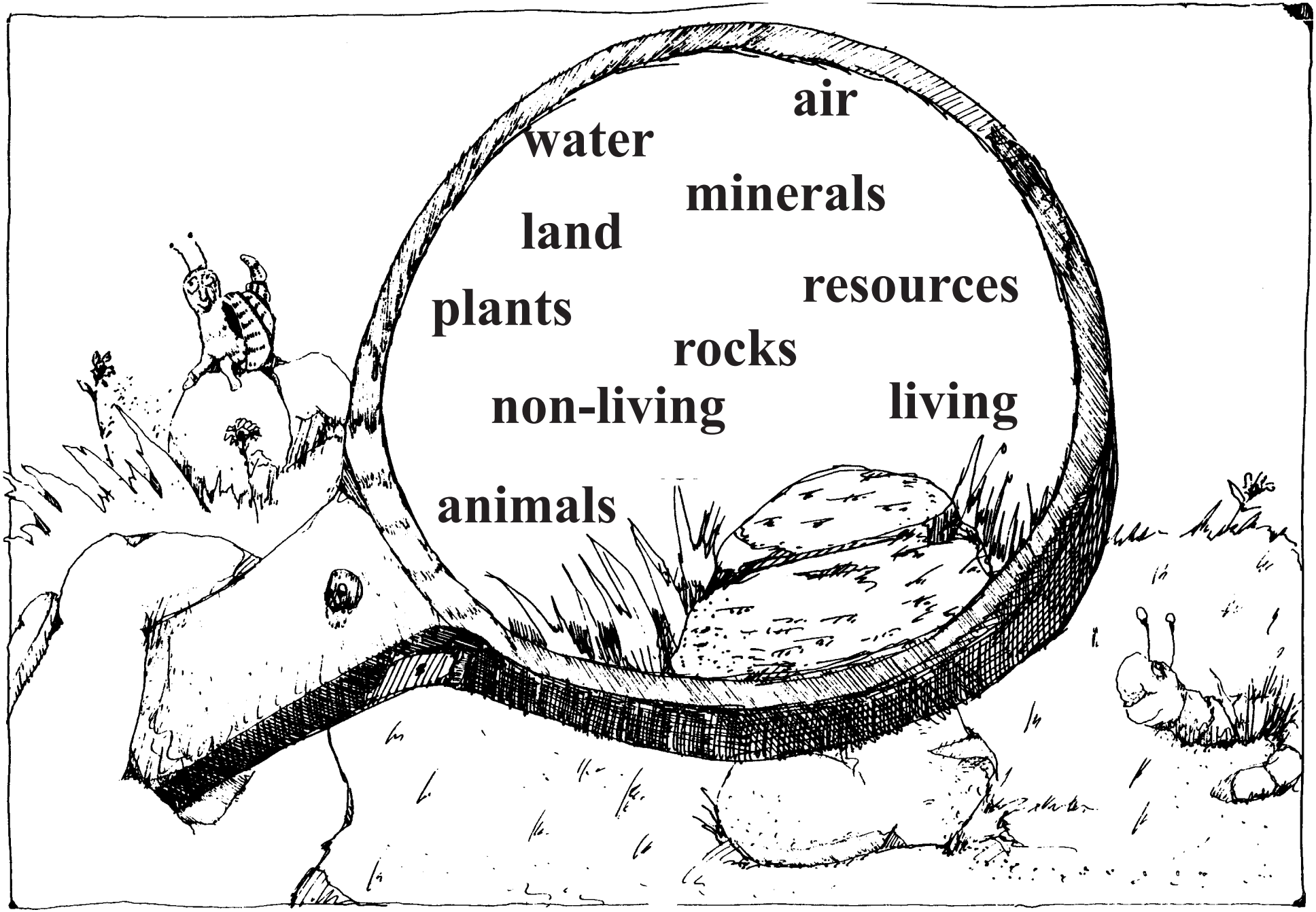
Natural Resources and Your Christmas Tree
Type: Lessons & Activities
Science 5-8.A (Science as Inquiry)
Science 5-8.F (Personal and Social)

Make Your Own Paper Model of a Volcano
Type: Lessons & Activities
Science 5-8.A (Science as Inquiry)
Science 5-8.D (Earth and Space)
Science 5-8.F (Personal and Social)

Materials Standards Compliance
Everything We Use Comes From Natural Resources
Grade Level: 9-12

Make Your Own Paper Model of a Volcano
Type: Lessons & Activities
Science 9-12.A (Science as Inquiry)
Science 9-12.D (Earth and Space)
Science 9-12.F (Personal and Social)

Natural Resources are all around us



Where Do Things Come From?

Is it Animal?

Is it Vegetable?

Is it Mineral?

Name_____

Your Shoes
____Animal
____Vegetable
____Mineral

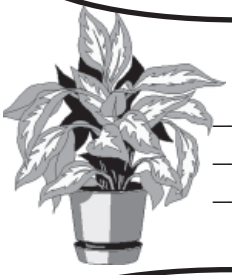
Your School
____Animal
____Vegetable
____Mineral

Animal

Food
____Animal
____Vegetable
____Mineral

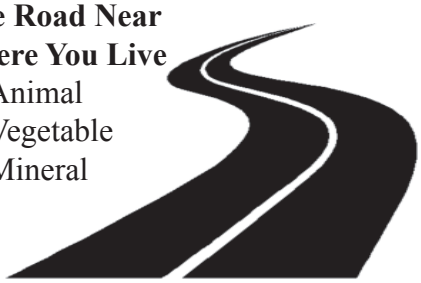
Vegetable

Teddy Bear
____Animal
____Vegetable
____Mineral



Plant
____Animal
____Vegetable
____Mineral

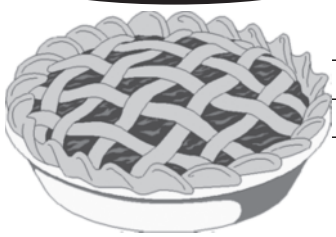
The Road Near Where You Live
____Animal
____Vegetable
____Mineral

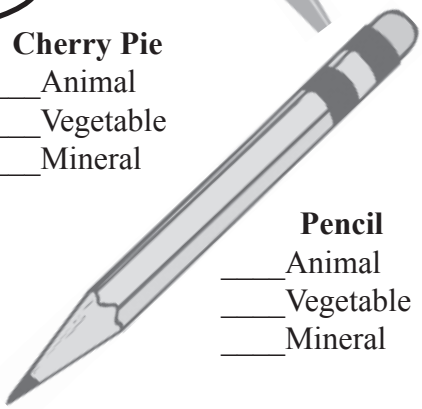


Mineral

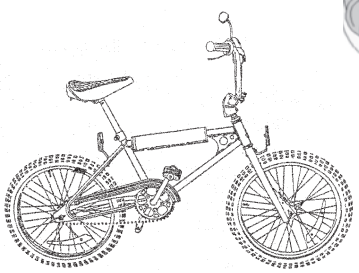
Crayons
____Animal
____Vegetable
____Mineral

Cherry Pie
____Animal
____Vegetable
____Mineral





Bicycle
____Animal
____Vegetable
____Mineral



Pencil
____Animal
____Vegetable
____Mineral

Some things can be made of all three—Animal, Vegetable, <u>AND</u> Mineral.

Everything comes from our natural resources.

Where Do Things Come From?

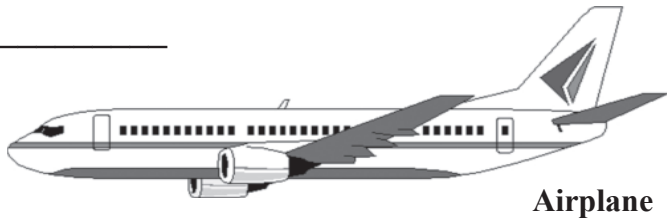
Is it Animal?

Is it Vegetable?

Is it Mineral?

Name_____

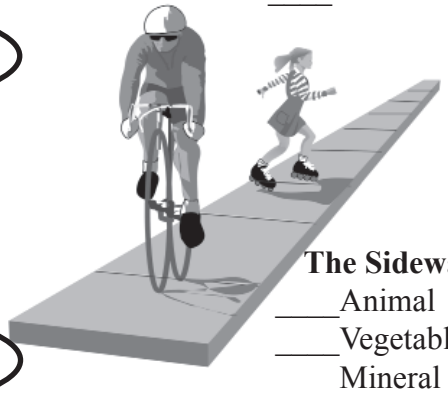
Your House
____Animal
____Vegetable
____Mineral



Airplane
____Animal
____Vegetable
____Mineral

Animal

Car
____Animal
____Vegetable
____Mineral

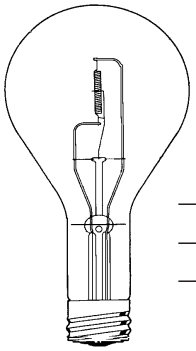


The Sidewalk
____Animal
____Vegetable
____Mineral

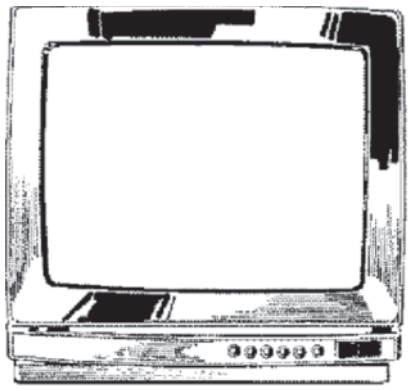
Vegetable

Glasses
____Animal
____Vegetable
____Mineral

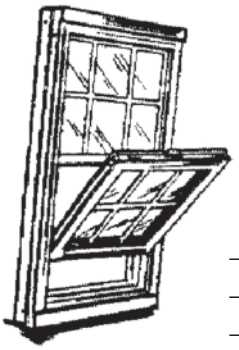
Mineral



Lightbulb
____Animal
____Vegetable
____Mineral



Television
____Animal
____Vegetable
____Mineral

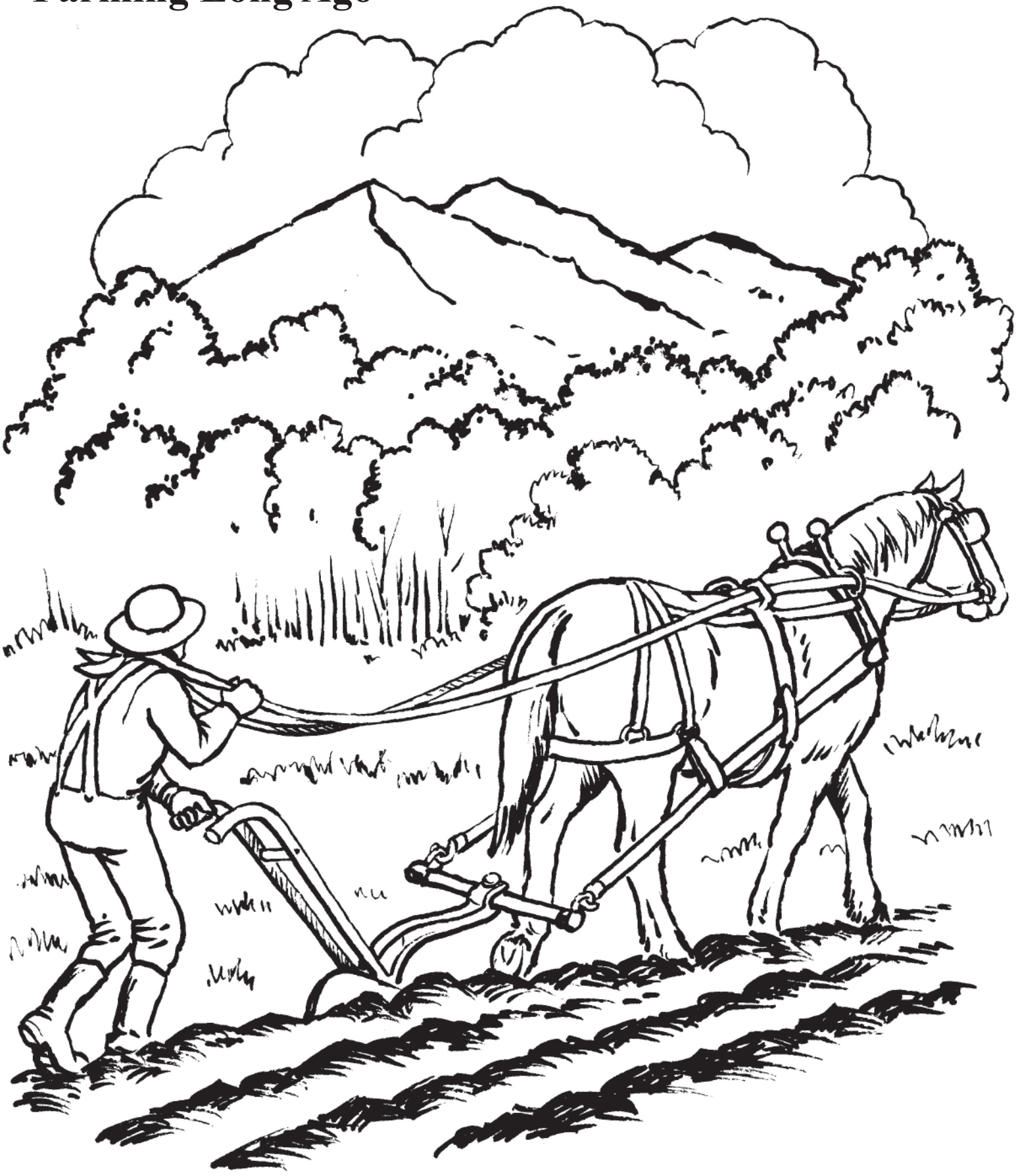


Window
____Animal
____Vegetable
____Mineral

Some things can be made of all three—Animal, Vegetable, AND Mineral.

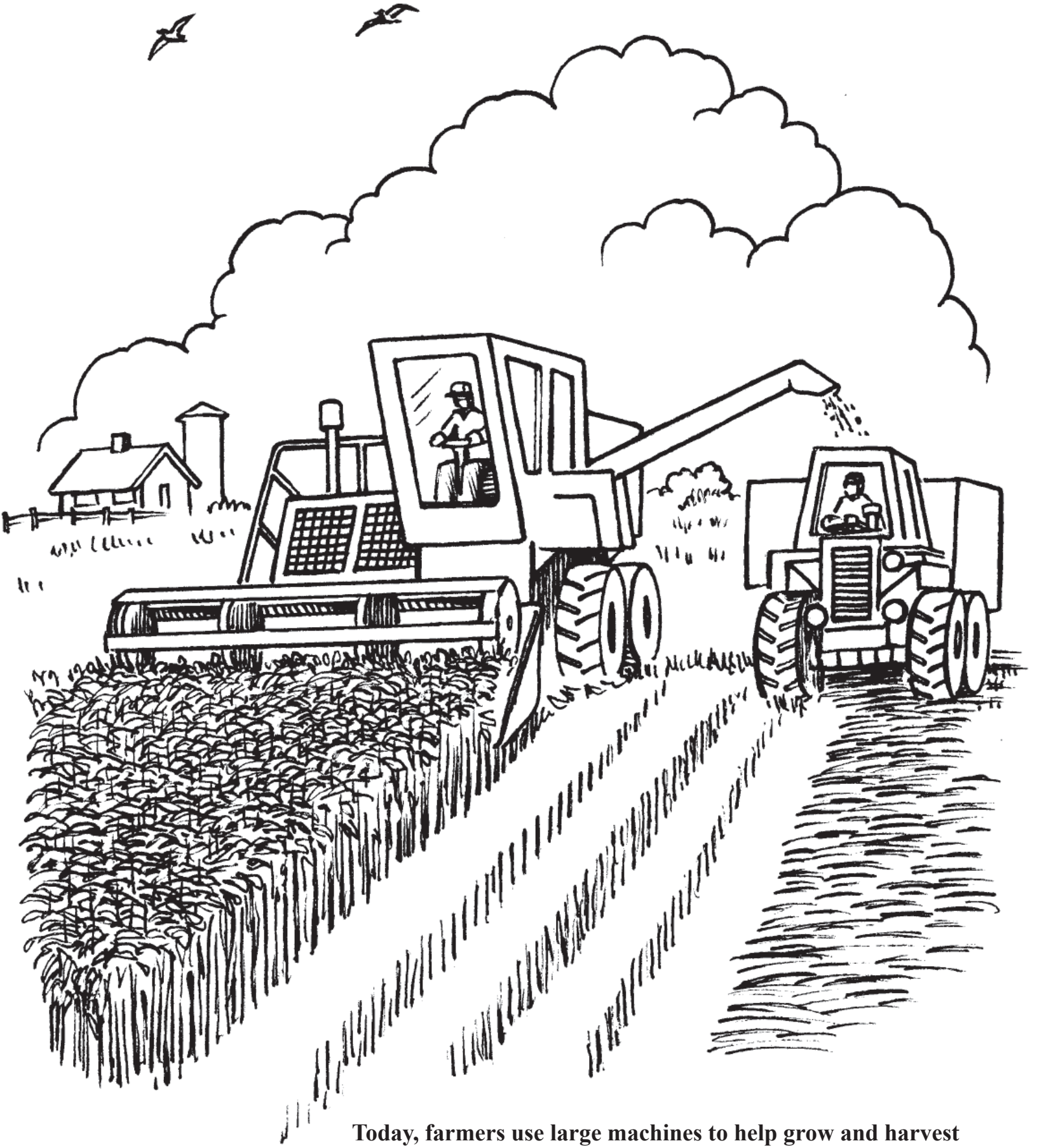
Everything comes from our natural resources.

Farming Long Ago



Long ago, many people were farmers who worked hard to grow food for their families.

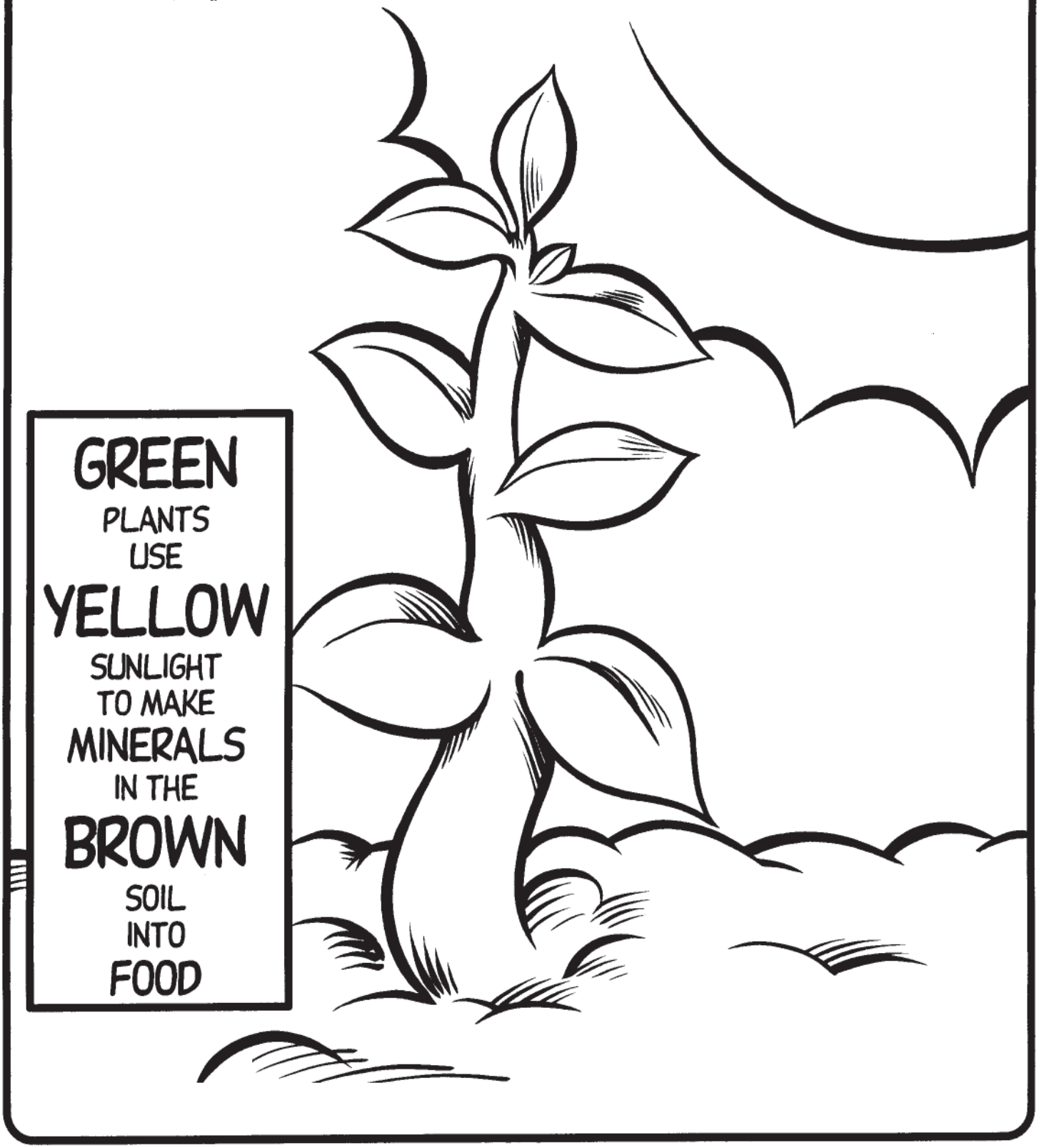
Farming Today



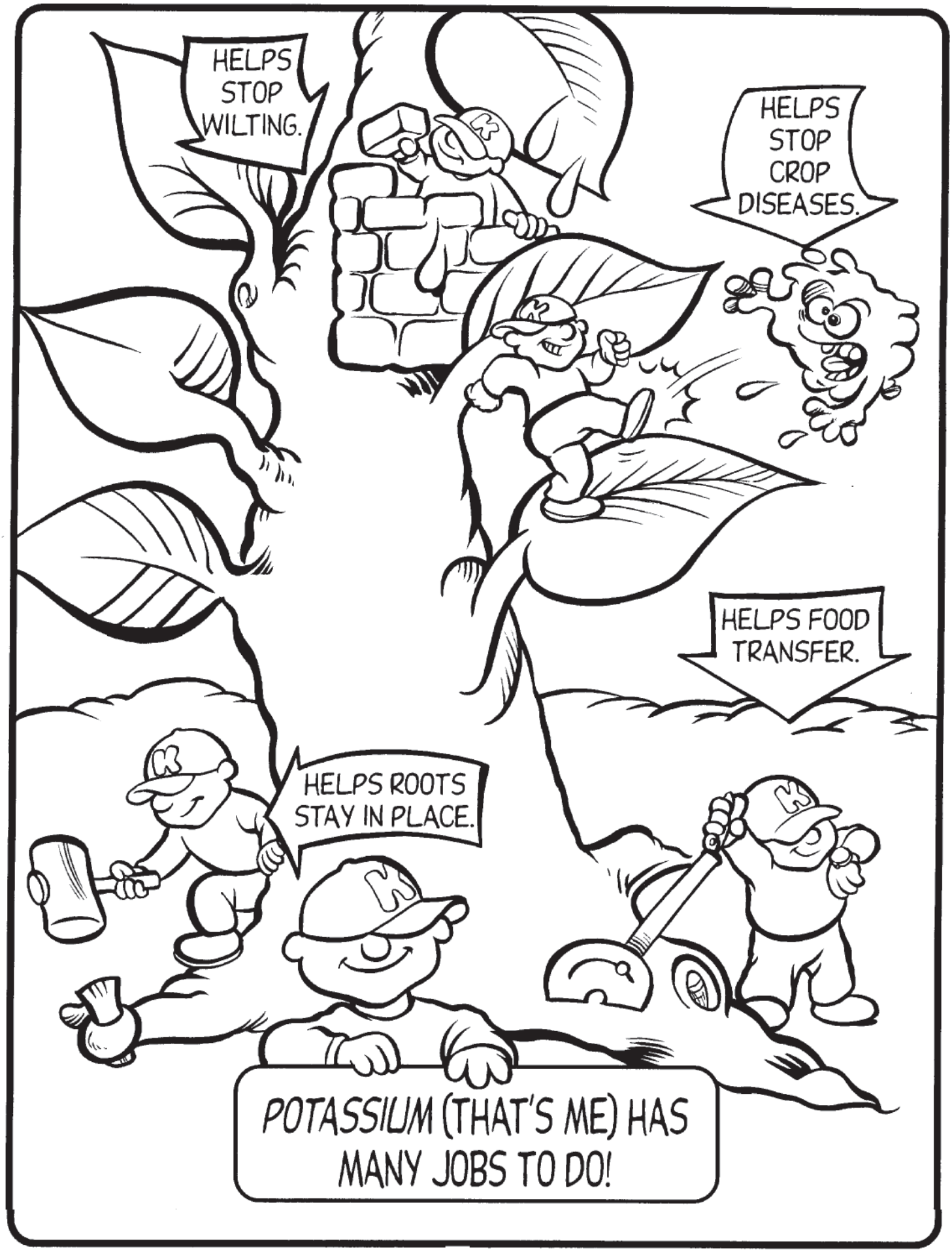
Today, farmers use large machines to help grow and harvest the food that feeds people all over the world.

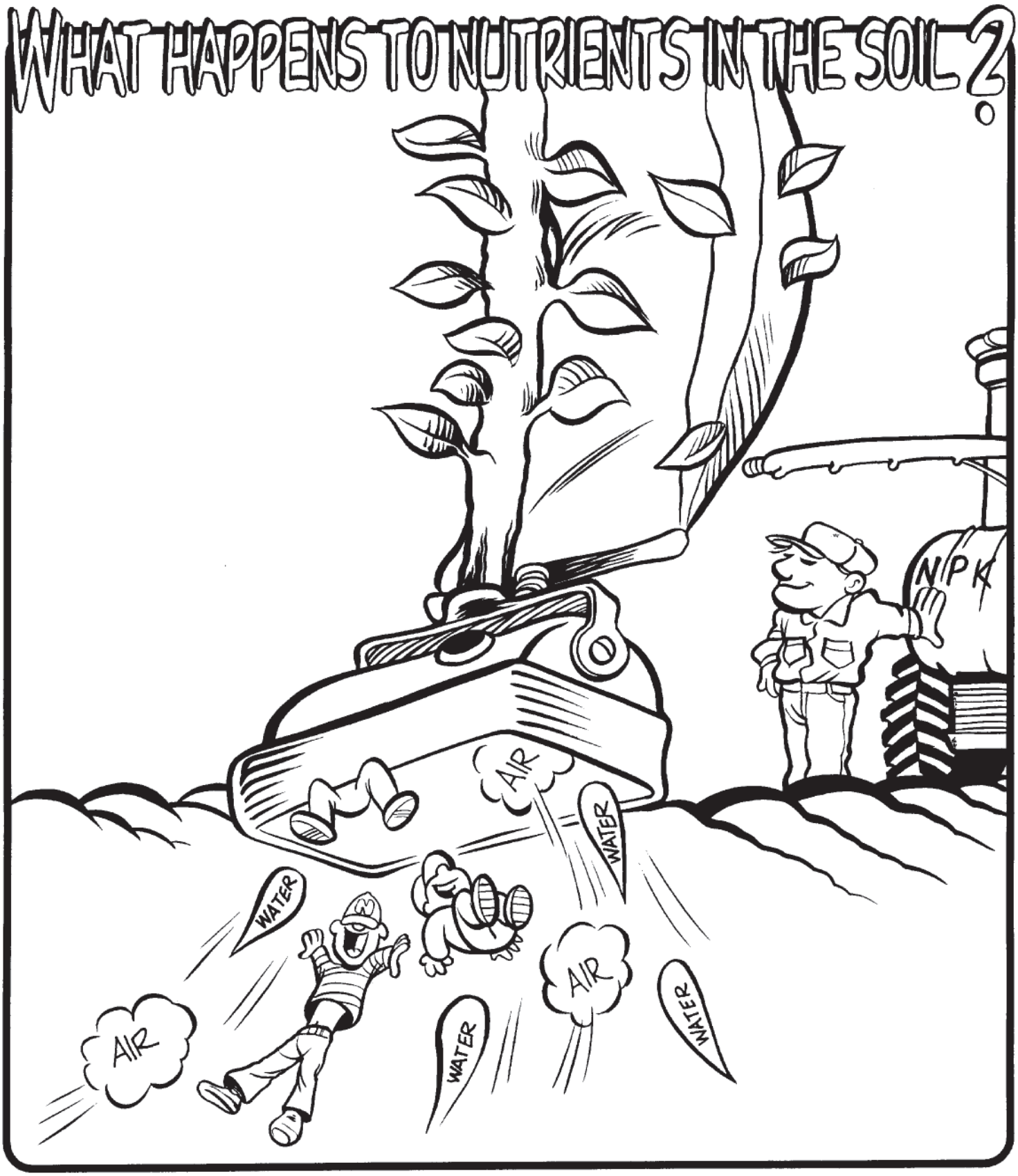
PHOTOSYNTHESIS

PHOTOSYNTHESIS IS THE WAY PLANTS USE SUNLIGHT TO MAKE ENERGY FOR THEMSELVES SO THEY CAN GROW.

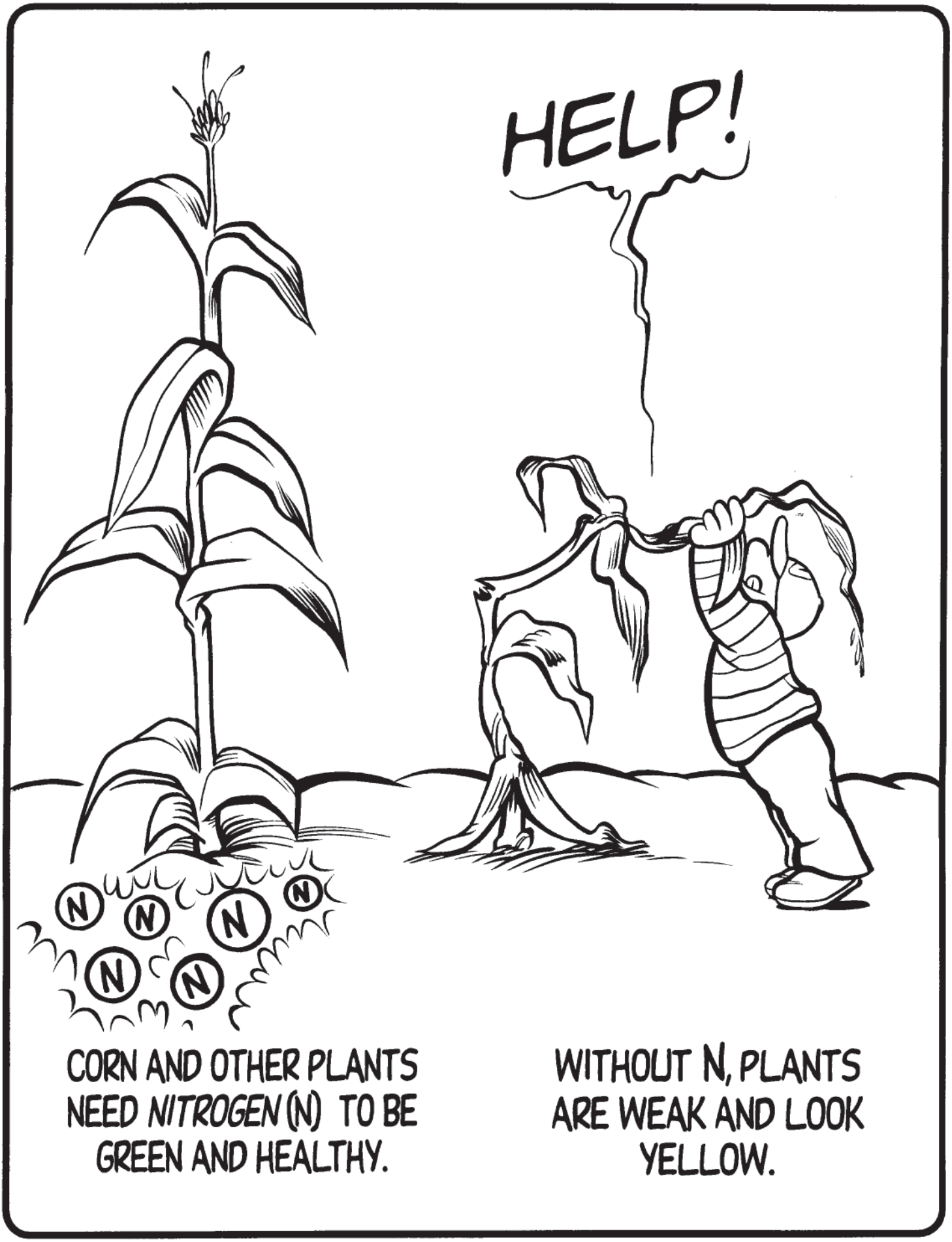



PHOSPHORUS (P) HELPS THE PLANT CATCH THE SUN'S ENERGY.
P
P
P
P
PLANTS NEED P FOR HEALTHY ROOTS


HELPS STOP WILTING.
HELPS STOP CROP DISEASES.
HELPS FOOD TRANSFER.
HELPS ROOTS STAY IN PLACE.
POTASSIUM (THAT'S ME) HAS MANY JOBS TO DO!



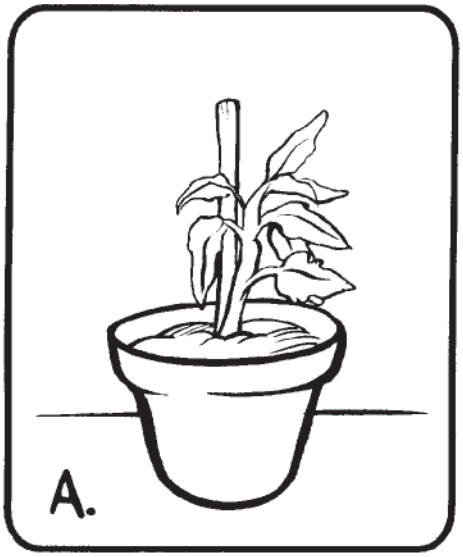
AS PLANTS GROW, HEALTHY ROOTS TAKE UP N-P-K AND OTHER NEEDED NUTRIENTS AS WELL AS AIR AND WATER FROM THE SOIL. THAT'S WHY NUTRIENTS HAVE TO BE ADDED BACK TO THE SOIL.

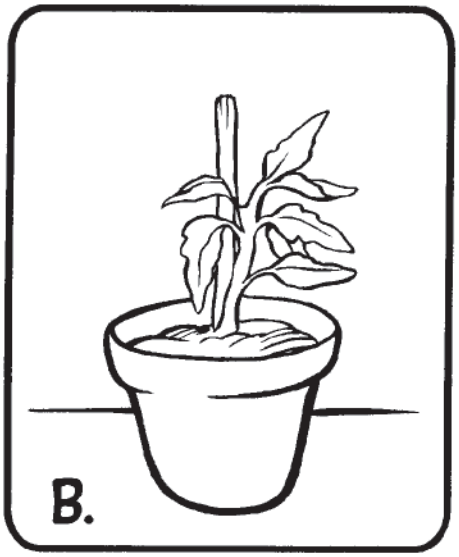

HELP!
N
N
N
N
N
N
CORN AND OTHER PLANTS NEED *NITROGEN* (N) TO BE GREEN AND HEALTHY.
WITHOUT N, PLANTS ARE WEAK AND LOOK YELLOW.

FUN WITH THE PLANT NUTRIENT TEAM, from the International Plant Nutrition Institute www.ipni.net

LET'S DO AN EXPERIMENT!

LET'S SEE WHAT HAPPENS TO PLANTS WHEN THEY DO NOT HAVE FOOD AND SUNLIGHT.

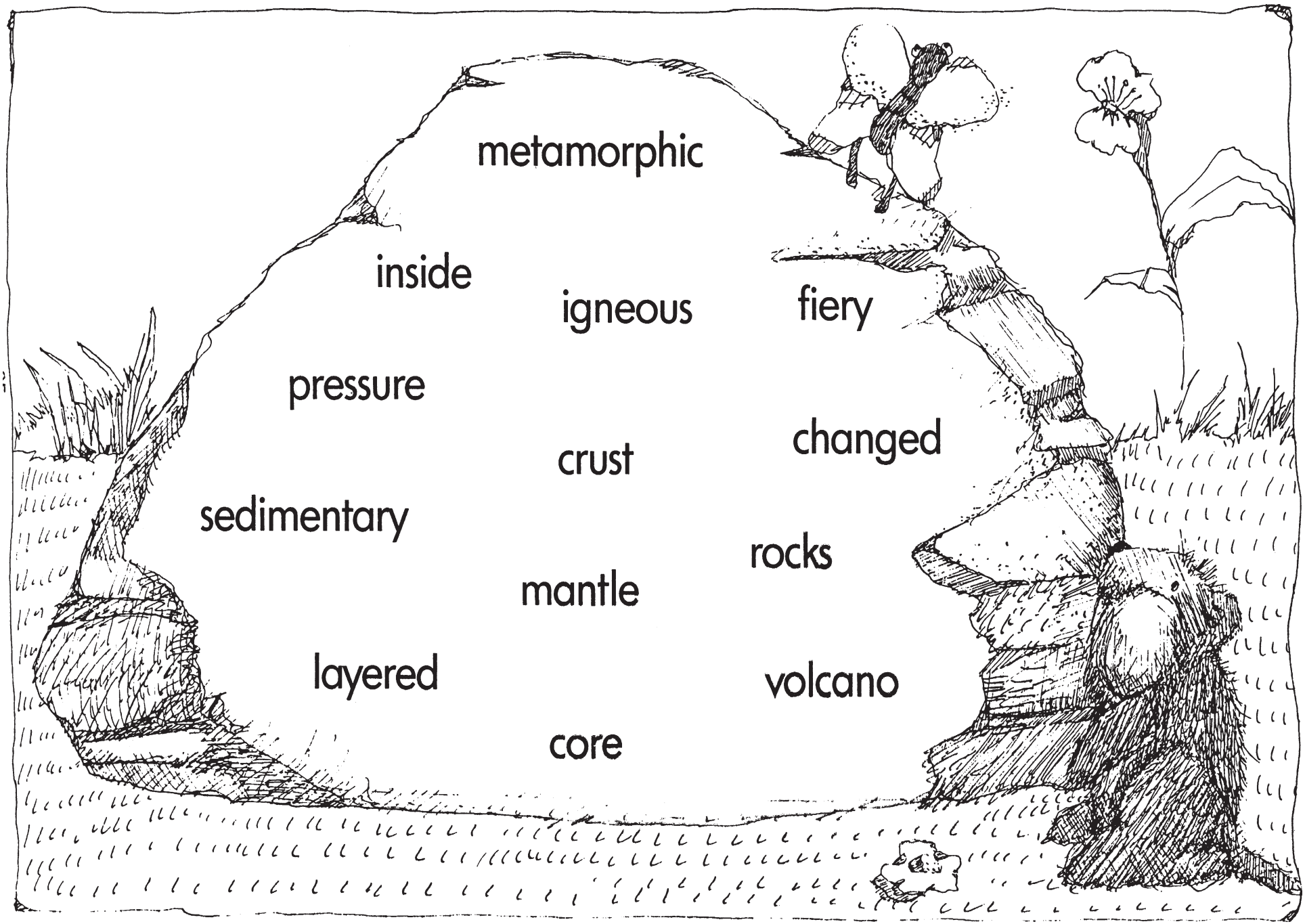




☐ DISTILLED WATER	☐ TAP WATER	☐ TAP WATER
☐ SAND	☐ GOOD SOIL	☐ SAND
☐ SUNLIGHT	☐ SUNLIGHT	☐ NO SUNLIGHT
DAY 1	DAY 1	DAY 1
DAY 4	DAY 4	DAY 4
DAY 7	DAY 7	DAY 7
DAY 11	DAY 11	DAY 11
DAY 14	DAY 14	DAY 14

Name _____

Rocks All Around Me



ROCK SOLID Publications

Rock & Mineral News

Rocks and Minerals Are All Around Us

A special report by _____ (your name)

Special Report: Rocks . . . . . Page 2
Special Report: Minerals . . . . Page 3

There are more than 3,000 different kinds of rocks and minerals.
This Special Report is about

_____ (Rock name) *and*

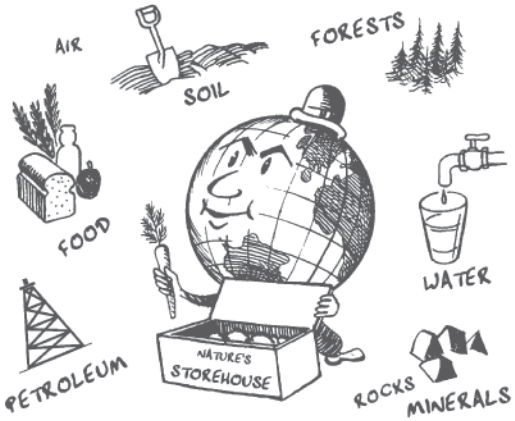
_____ (Mineral name)

Remember

The most important thing I want people to remember from my report is

_____
_____
_____
_____
_____

Our Natural Resources



Everything We Have Comes From Our Natural Resources

In addition to the air and water, we use natural resources every day. Here are 3 things I use that are made from our natural resources.

1. _____
2. _____
3. _____

Below are pictures of the rock and mineral resources I studied for this report.
On the left is the rock _____ . On the right is the mineral _____ .

Draw or paste pictures for your rock and mineral report above.

This page, and the next 3 pages, are intended to provide you with ***OVERSIZE*** report pages for your students to use. Enlarge them at 154% onto 11" by 17" paper. If your copier doesn't duplex, tape the sheets together along the edge and provide your students with a ***Tabloid Newspaper*** for their reports.

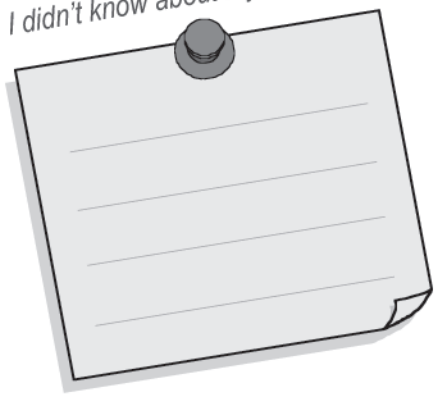
Special Report About Rocks

The rock I am writing about is _____
(name of your rock)

Identify the type of rock you have and how it was formed.

Geology

Interesting Fact
I didn't know about my rock

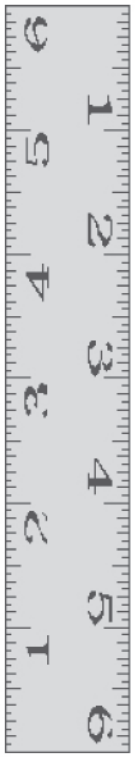


Is your rock common and found in many places? Or is it rare, and found only in a few, special places?

Where _____ is Found
(rock name)

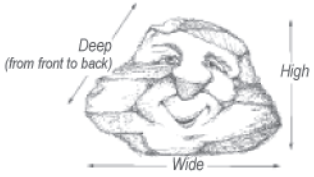
_____
(rock name)

❒ is
❒ is not found near where I live.



Rocks occur in all sizes, from smaller than sand to bigger than houses. My rock is

_____ inches high,
_____ inches wide, and
_____ inches deep.



❒ I had a real rock sample to study to help research and write this report.

❒ I did not have a sample to study.

Most rocks are used to build things you use every day. Is there a special or famous use for your rock?

How _____ is Used
(rock name)

Special Report About Minerals

The mineral I am writing about is _____ (name of your mineral)

It was discovered in _____ (year) by _____ (name of person) .

Geology

I can identify minerals by studying their special characteristics.
This is what I found out studying _____ (name of your mineral)

Color is _____

Weight— is heavy for its size ❒ Yes ❒ No

Magnetic— is attracted to a magnet ❒ Yes ❒ No

Hardness— can be scratched by a nail ❒ Yes ❒ No

— can scratch other rocks and minerals? ❒ Yes ❒ No

If so, which ones? _____

Luster is _____

Floats on water? ❒ Yes ❒ No

Interesting Fact I learned about my mineral

_____ (mineral name)

❒ is
❒ is not *found in the state where I live*

Some minerals are rare and are not found in many places? Which U.S. states, Canadian provinces, and other countries have deposits of your mineral.

Where _____ (mineral name) **is Found**

States/Provinces	Major Countries

❒ *I had a mineral sample to study to help research and write this report.*

❒ *I did not have a mineral sample to study.*

What Do You Think? *Paste or draw a picture of the most useful product you use that is made with your mineral.*

Most minerals have many uses.
Is there a special or famous use for your mineral.

Uses of _____ (mineral name)

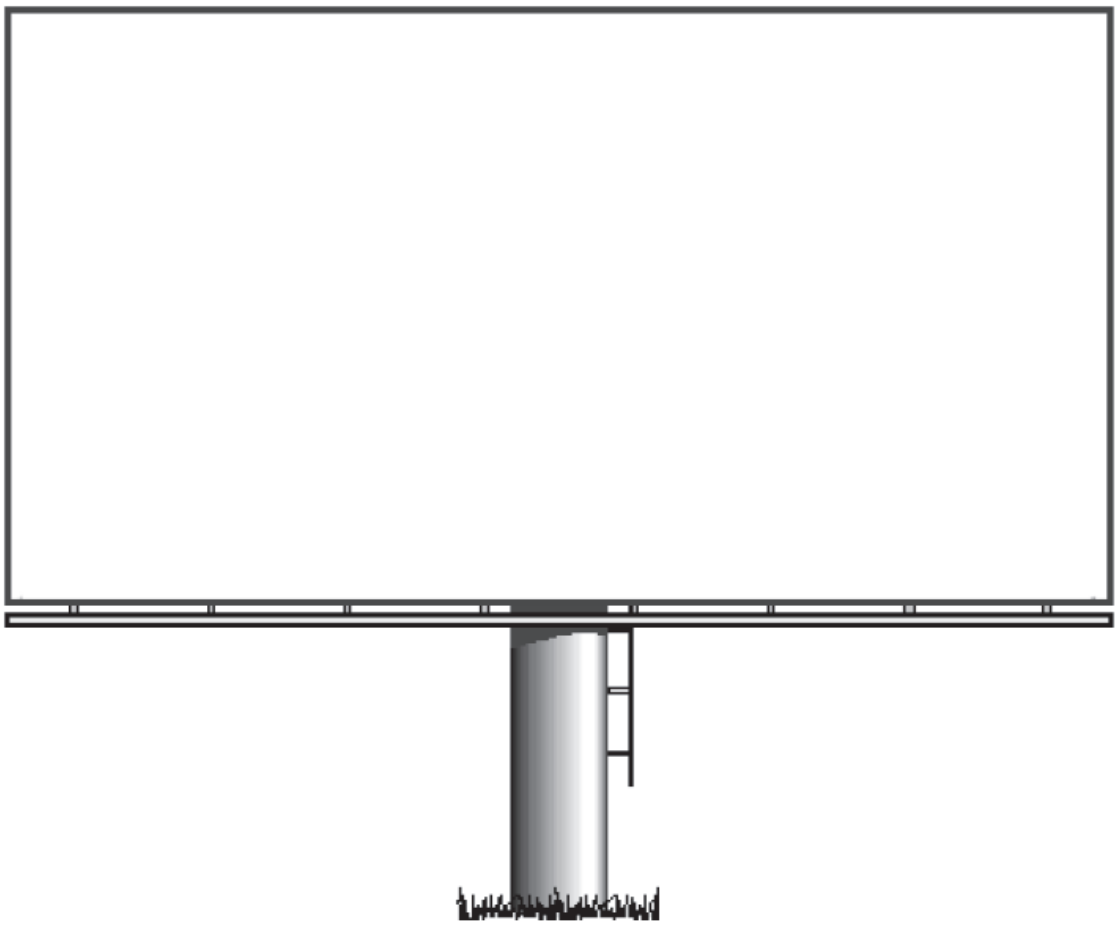
I didn't know _____ (mineral name)

was used to make _____

Is there a substitute material (a different mineral) that can be used if we run out of your mineral?

❒ Yes ❒ No

Design a billboard advertisement for your rock or mineral.



The Sources of Information for My Report Were:

People I spoke with:

_____

_____

Books, Magazines, Newspapers:

_____

_____

Internet Sites:

www._____

www._____

Other Sources:

_____

_____

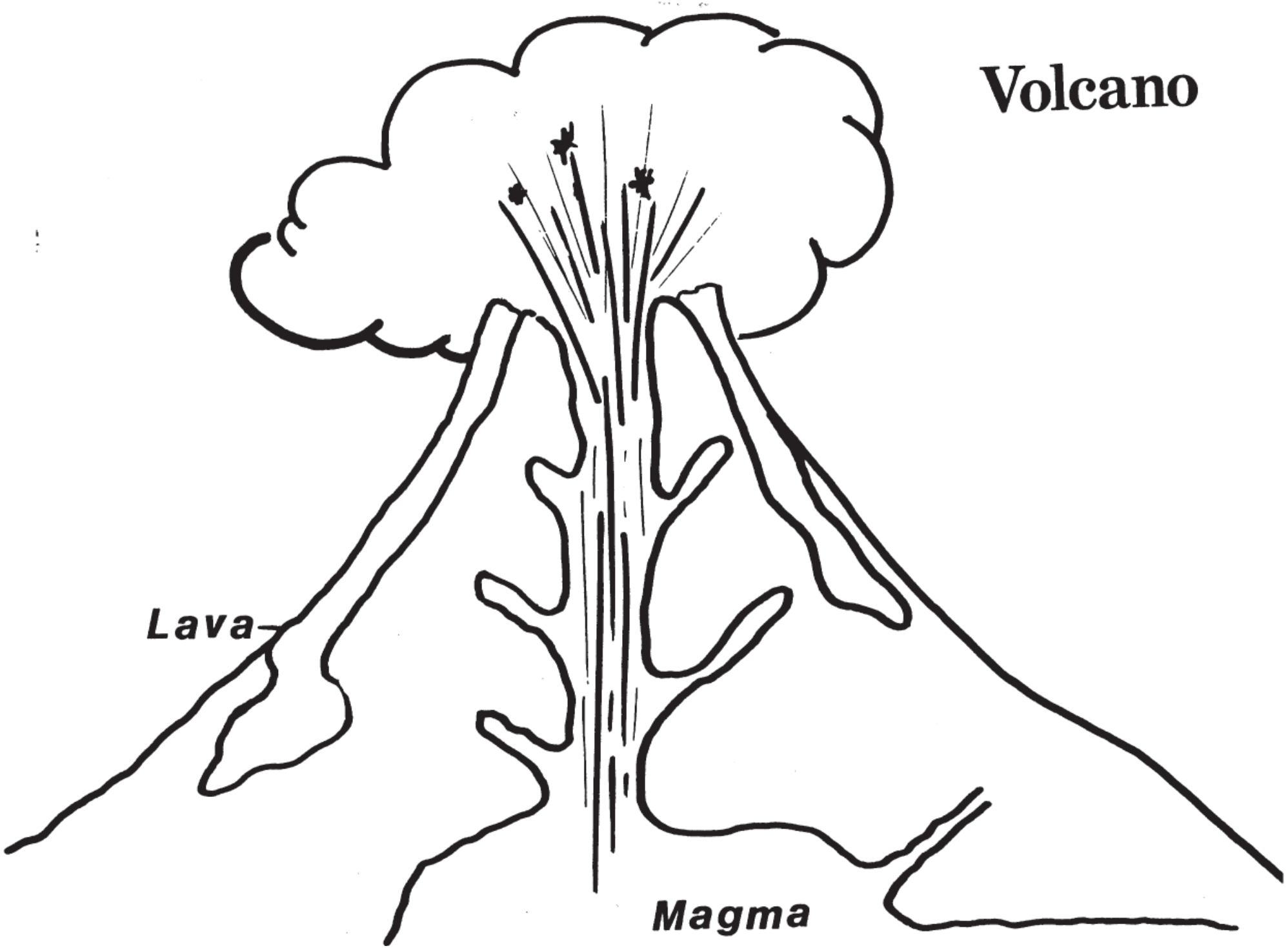
Which was your most important source? _____

Why? _____

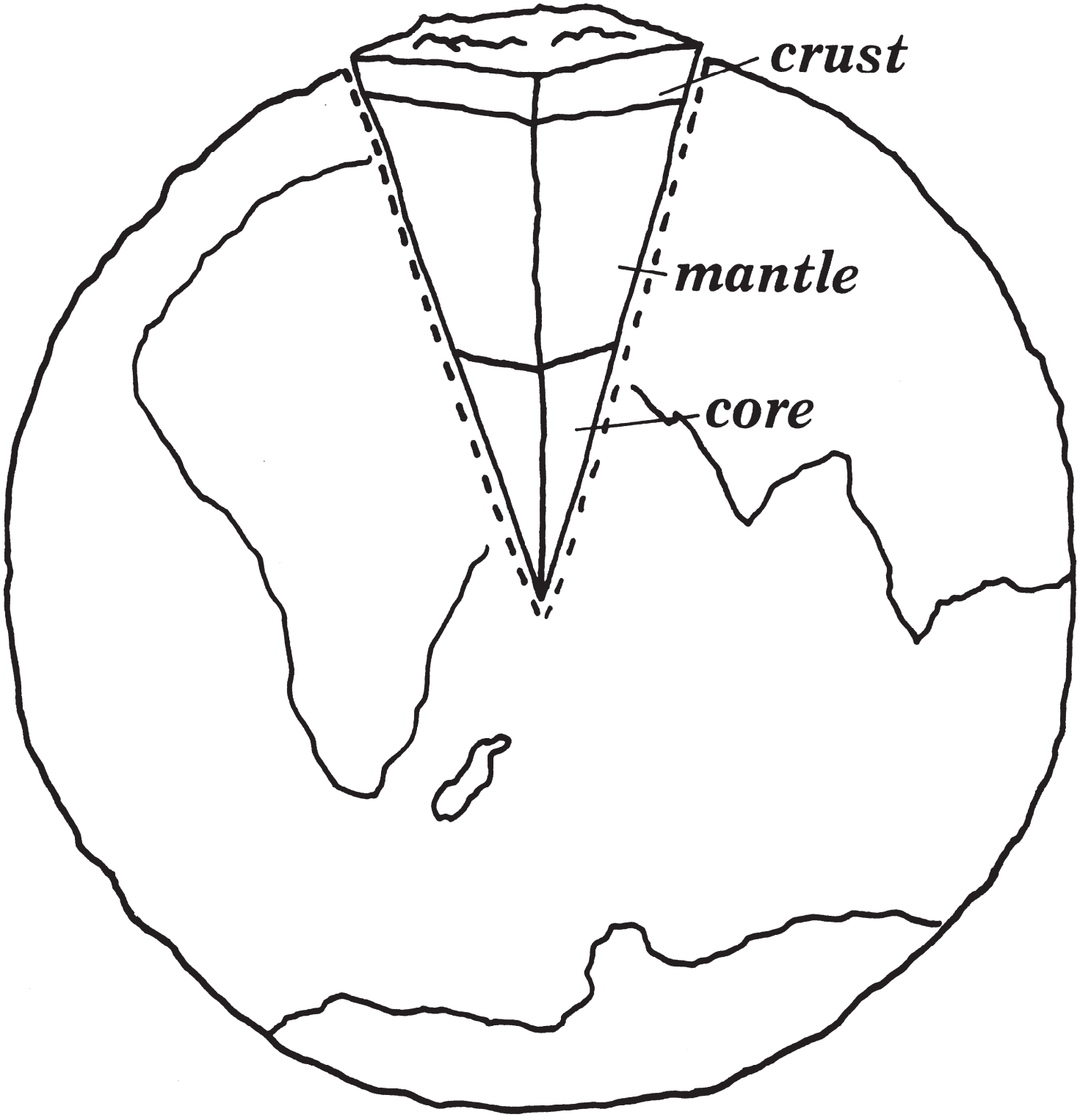
Enlarge to 154% ***Tabloid Newspaper*** report, page 4


A
rock
is . . .

Volcano



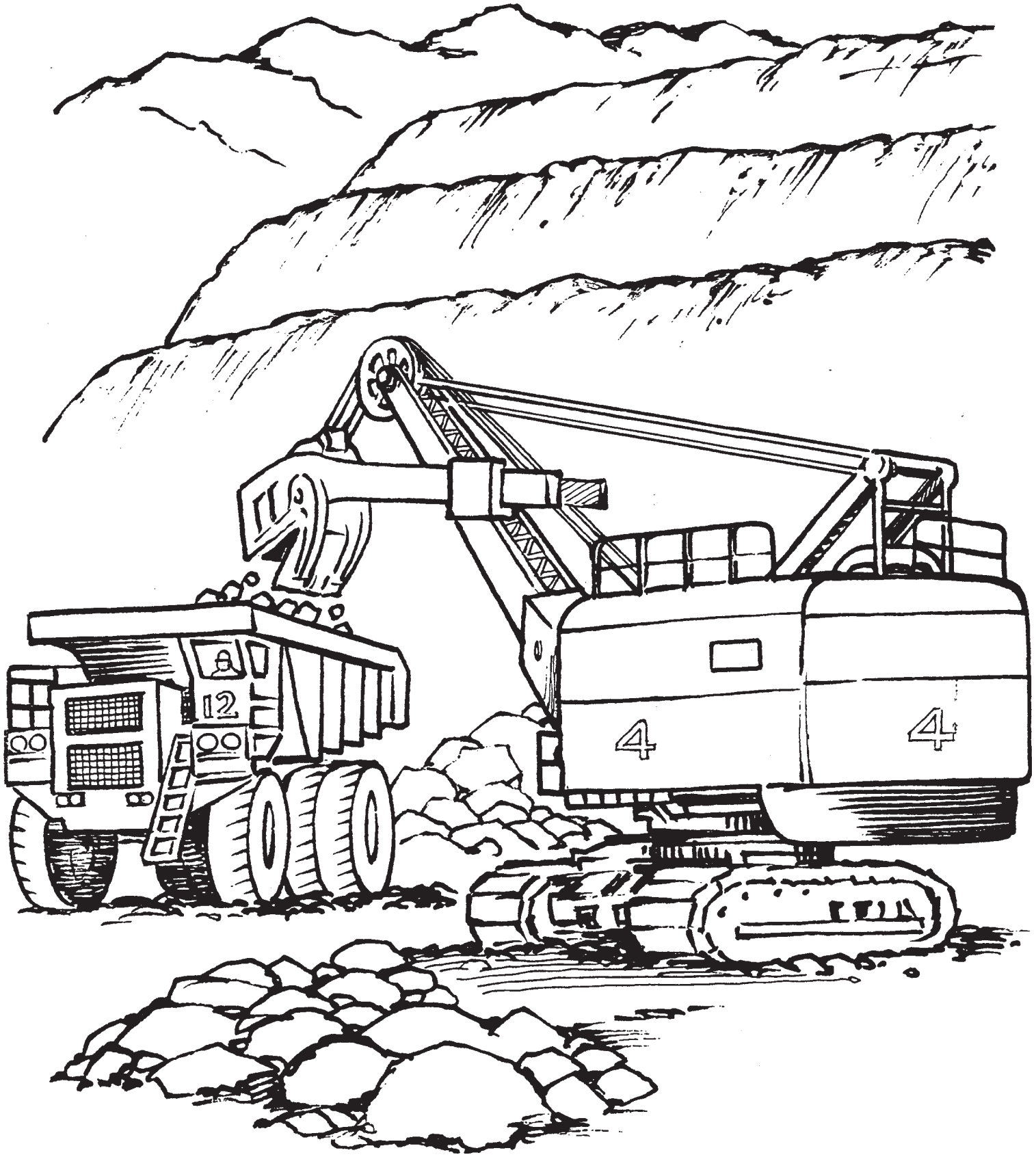
The Earth, My Home



Mining Long Ago

**Miners helped settle much of the Wild West.
His burro was an important tool.**

Mining Today



Most people have never seen a mine, but we all use the things that are made from the special rocks that are dug out of the ground. Are there special rocks mined near where you live?

Turn on A Light

And Do Your Own Revegetation

Use electricity and plant a seed. That's the process when coal is the major fuel to produce electricity.

You flip a light switch and the room brightens with a glow. It's the electricity delivered to your home that provides the power to light the bulb. It also provides the energy for your television, refrigerator, washing machine, computer and other machines.

With nearly 50% of the electricity in the United States produced by coal-burning power plants, whenever you use electricity, you are causing more coal to be mined. And whenever coal is mined, the land must be reclaimed because that's the law.

Before the first ton of coal can be mined, reclamation permits must be obtained from various state and federal agencies to ensure that the land will be returned to a beneficial use when mining has been completed.

These permits describe in detail how the coal companies are going to mine and reclaim the land. The processes include vegetation removal, soil removal, rock or other overlying materials (overburden) removal, coal removal, placement of the broken rock and other materials back in the place where coal was removed (backfilling).

Then, contouring the land surface to resemble the landscape as it looked before mining, soil replacement, and topsoil placement, seeding, mulching and fertilizing if necessary, and paying attention to revegetation standards. (If trees were removed, new trees will be transplanted. If there was a pasture field or a corn field, these lands have to be able to support and produce pasture or corn.)

A small but important part of any reclamation process is the selection and placement of the seeds that will be used to revegetate the disturbed land. After we have used one of our natural resources, by reclaiming the land we are returning it for other beneficial uses, which might include farm or grazing land, wildlife use, forests and parks, or some other use.

See the success of reclaimed mines at www.mii.org/recl.html

Mining inevitably disturbs land. Modern mines reclaim the surface during and after mining is completed, returning the land to useful purposes.

www.mii.org has about 300 mined land reclamation success stories. The reclaimed mine lands are often more attractive to wildlife and human uses than before mining started.

Make sure to notice the differences in the pictures between how the land looks during mining and how the reclaimed areas look after mining.

Activities

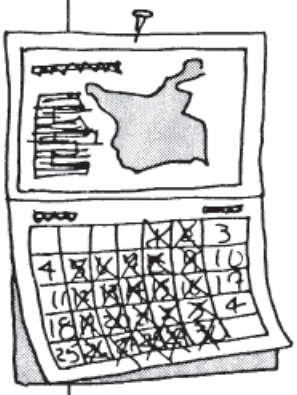
- Have your students compile a list of things in their home that use electricity.
- Plant a grass seed in your school playground to see if you can successfully reclaim a disturbed area. Remember, mines MUST BE successfully reclaimed. IT'S THE LAW.
- Experiment with different types of water, fertilizer, and soil types to provide living examples of what influences plant growth.
- Find out where your electricity comes from, and the fuel that is used to produce it.

Original activity from the Office of Surface Mining, Denver, Colorado.

How much does it cost to light your school?

Materials

Pencil and paper
Classroom with fluorescent bulbs
Chalkboard and colored chalks
OR
Newsprint pad and felt-tipped markers



First determine how much electrical energy it takes to light your classroom for 1 hour, then compute the cost. Record this amount on the table below.

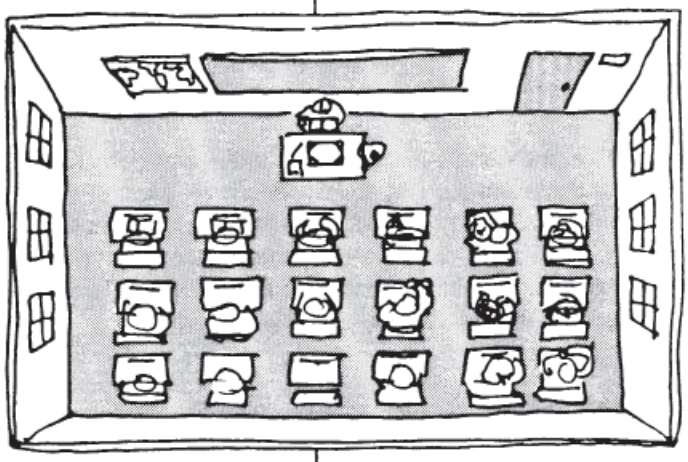
Number of tubes in your classroom	×	0.3¢*	=	Cost per hour to light your classroom

Then, compute how much it costs to light your classroom for 1 day. Record below.

Cost per hour to light your classroom	×	Hours per day classroom is lit	=	Cost per day

***Note**
Fluorescent tubes cost about 0.3¢ per hour for the electricity needed to light them. The cost of electricity ranges from 0.013¢ to 0.038¢ per hour, depending on where you live.

How much does it cost to light your classroom for 1 week? 1 month? 1 year? How many kilowatt hours (kwh) of electricity were used?
How many fluorescent tubes are there in your school? How many classrooms? How much does it cost to light your entire school for 1 hour? 1 day? 1 week? 1 month? 1 year? How many kwh of electricity were used? Record your calculations below.



	Classroom	School
Cost per hour		
Cost per day		
Cost per week		
Cost per month		
Cost per year		
Kilowatt hours used		
Tons of coal used		

An average 2500 kwh of electricity are produced by burning 1 ton of coal. How many tons of coal would it take to light your classroom? Your school?

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1 of 9 Activities from
Coal: An Introduction,

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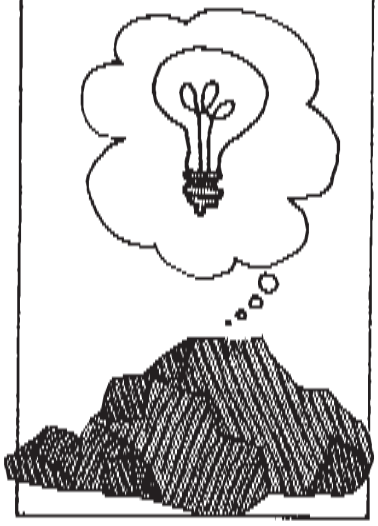


Guide To Activities

How much does it cost to light your school?

Concept

Coal produces more than half of the electricity used in the United States, and is our most abundant domestic nonrenewable energy source.

Objective

The students will compute the cost of electricity used to light their classroom and their school for one hour through one year, the number of kilowatt hours of electricity used, and the number of tons of coal mined and burned to produce the electricity used.

Curriculum Skills/Processes

Observing, collecting data, computing, organizing, and discussing.

Time

One to two class periods, with assignments.

Background

More than 75% of the coal mined in the United States is used to produce electricity. Typically it takes about one ton of coal to produce 2500 kilowatt-hours of electricity. By checking the number of kilowatt-hours used during a billing period, a customer can determine how many pounds of coal were used to meet his or her needs—presuming that all the power was coal-generated, of course.

Here are some examples of how much coal is used yearly by a family of four to produce the electricity needed to operate various appliances:

Electric water heater — 3,375 pounds
Electric iron — 48 pounds
Vacuum cleaner — 37 pounds
Color television, solid-state — 256 pounds
Range — 560 pounds
Hairdryer — 20 pounds
Clock — 14 pounds

The U.S. has approximately 30% of the world's coal reserves. Today, electricity can be produced more cheaply from coal than from oil, gas, or nuclear power. Most of the costs of mining and burning coal in an environmentally safe manner are included in the cost of today's coal. Consequently coal should remain a reasonably priced source of electricity compared to other sources. The cost of transportation to deliver coal to the power plant can be the largest influence in the price people pay for electricity.

Action

Have the students do the calculations listed in the activity and fill in the chart provided. Discuss the actual cost per hour to operate a fluorescent bulb in your area and the reasons that regional electrical costs vary.

Results/Teaching Suggestions

Find out and discuss where your electricity comes from. It might start from a coal mine thousands of miles away. Discuss the importance of the "cost" of electricity. Help students realize that everyone uses electricity and the fuel that created it.

Other Ideas to Explore

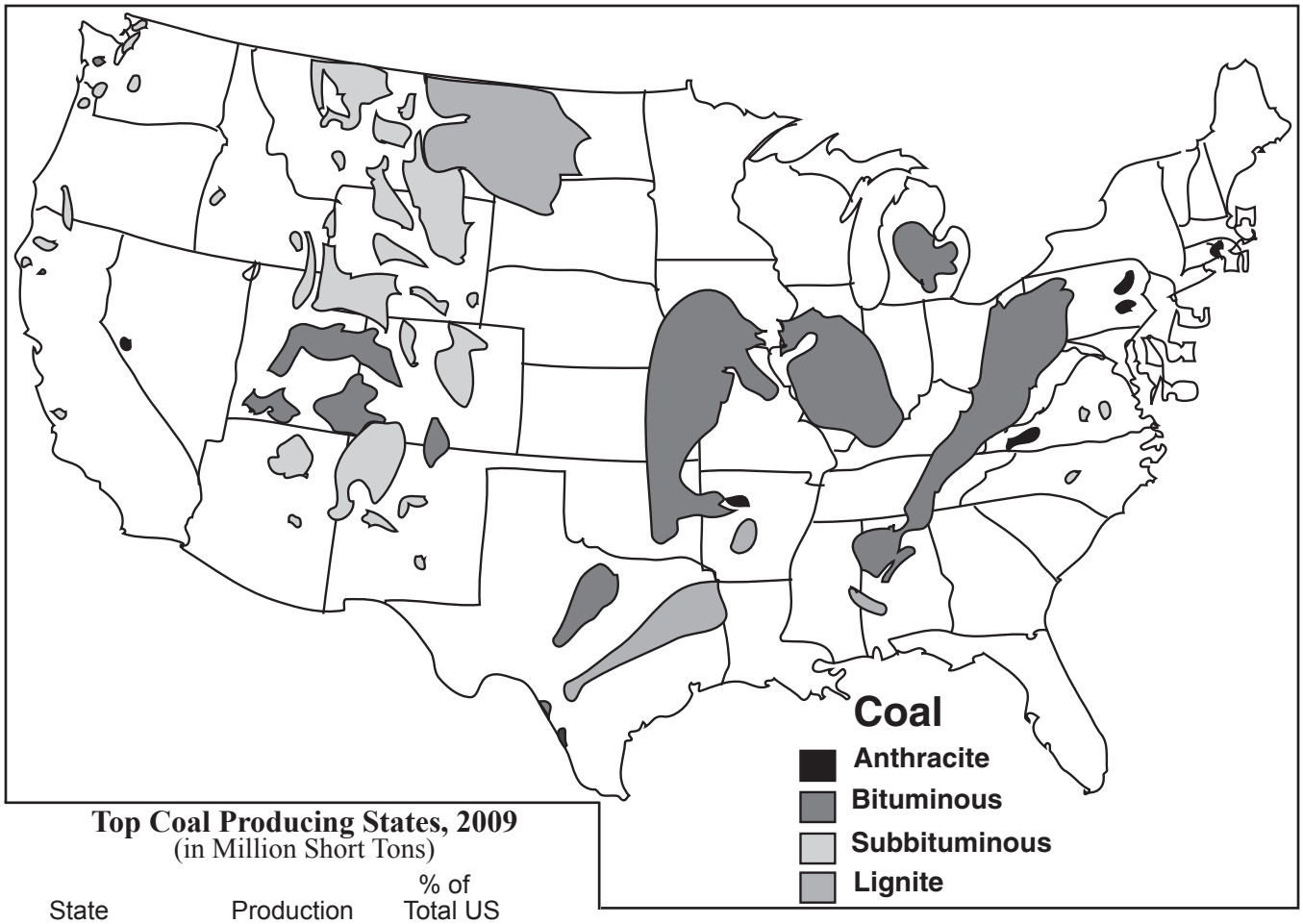
Discuss how you could "lower" the cost of lighting your classroom and your school.

Why is coal a good fuel source for producing electricity?

What are some of the problems we need to solve to make coal a better fuel source?

Coal Areas in the United States

The information below tells which states mine coal and how much they produced in 2009



Top Coal Producing States, 2009
(in Million Short Tons)

State	Production	% of Total US
Alabama	18.8	1.8%
Alaska	1.8	0.2%
Arizona	7.5	0.7%
Colorado	28.3	2.6%
Illinois	33.8	3.2%
Indiana	36.6	3.4%
Kentucky	106.1	9.9%
Louisiana	3.7	0.3%
Maryland	2.3	0.2%
Mississippi	3.4	0.3%
Montana	39.5	3.7%
New Mexico	25.1	2.3%
North Dakota	29.9	2.8%
Ohio	27.4	2.6%
Oklahoma	1	0.1%
Pennsylvania	58.1	5.4%
refuse rec	2.1	0.2%
Tennessee	2.1	0.2%
Texas	35.1	3.3%
Utah	21.7	2.0%
Virginia	20.5	1.9%
West Virginia	136.7	12.7%
Wyoming	430.7	40.2%

Total U.S. production = 1,072.2 million short tons

In the U.S., nearly half of the electricity that is generated uses coal as the fuel.

Questions:

1. What are the names of the ten states that produced the most coal in 2009.
2. Can you tell from this map (or list) how many tons of coal we have in the United States. Why or why not?
3. What region of the country does not have coal reserves?
4. Find out what fuel is used in your state to generate electricity? Does your state produce coal?
5. Computers (mostly the Internet) are credited with using more than 10% of all the electricity that is used in the U.S. What new demands for electricity do you think will occur in the future?

Fuels used in the U.S. to generate electricity.

Coal	Nuclear	Hydro	Natural Gas	Oil	Other
45%	20%	7%	23%	2%	3%

How Much Electricity Do You Use Each Year

In the United States, electricity can be created from many different sources. Nearly 50% of the electricity we use is generated by burning coal.

Coal	Nuclear	Hydro	Natural Gas	Oil	* Other
45%	20%	7%	23%	2%	3%

* Includes Renewable Energies (Solar, Wind, Geothermal, etc.) except hydro

Here are examples of how much coal is used each year by a family of four to produce the electricity needed to operate various appliances.

1.	Electric water heater	3,375 pounds
2.	Range	560 pounds
3.	Color television	256 pounds
4.	Electric Iron	48 pounds
5.	Hairdryer	20 pounds
6.	Vacuum cleaner	37 pounds
7.	Clock	14 pounds

One ton of coal can produce 2,500 kilowatt hours (kwh) of electricity. One ton equals 2,000 pounds.

1. If the family uses all of the appliances listed in the chart above, how much coal is used in one year?_____
2. How much coal does each family member use in one year, if each member uses the same amount of coal?_____
3. In one year, how many kilowatt hours of electricity are used by the family if they use all of the appliances?_____
4. How many years would the family have to use the range to equal the amount of coal used by the electric water heater in one year?_____
5. If the family bought its color television on September 1, how much coal did the television use for the remainder of the calendar year?_____
6. The family decided to purchase an additional electric iron. How much coal is used by both irons in one year?_____
7. During a five year period, one iron worked for all five years. The second iron worked for three years. During the fourth year, the second iron worked for eight months and during the fifth year for two months. How much coal was used by both irons during the five years?

Answers:

1. 4,310 pounds
2. 1,077 pounds
3. 5,262.50 kilowatt hours
4. 6 years
5. 85 pounds
6. 96 pounds
7. 424 pounds

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NATURAL RESOURCES AND YOUR CHRISTMAS TREE

Adapted from an article by **Doug Jones**, Student, Department of Geosciences, New Mexico Institute of Mining & Technology and **Virginia T. McLemore**, Economic Geologist, New Mexico Bureau of Mines and Mineral Resources

With the excitement of Christmas, the last thing on our minds is the natural resources that bring such pleasure to this holiday season. The lights, decorations, glitter on greeting cards, and wrapping paper add to the excitement of the holidays. Perhaps the image of the Christmas tree is the most memorable of all. Have you ever thought about the raw materials that bring together this image? The majority of these raw materials were furnished by the mining and petroleum industries.

Some people drive to the forest to cut Christmas trees. Most Christmas trees are grown on tree farms. Like all crops, the trees are grown with fertilizers. About half of the world's production of sulfur and over 90% of the production of phosphates and potash go into fertilizers, of which the sapling trees receive a share. Surface and ground water resources are also need for the growth of the trees.

Strands of tiny lights have replaced candles on the trees, adding to the list of minerals that bring holiday-cheer. The wires are made of copper; the insulation and wall plug are formed by the combination of petrochemicals with pumice, limestone, marble, vermiculite, silica, feldspar, or trona. The glass bulbs contain feldspar, silica, clay, nepheline syenite, and trona; filaments in the bulbs are made of thin conductive strips of tungsten metal, which comes from the minerals scheelite and wolframite.

The glittering tree ornaments are made of ingredients similar to light bulbs, and also contain borate and metals such as iron, copper, and lead. The star at the top of the tree could be made from either aluminum, silver, or copper. The ornament hangers and tree stand also are typically a metal alloy containing iron or aluminum. Colorful paints and glazes used to decorate the ornaments are based on petrochemicals, mica or clay, and are pigmented with ingredients such as lithium found in spodumene, titanium in rutile, manganese in pyrolusite, and rare earth elements in bastnesite and monazite. The papers and woods that the paints are applied to commonly contain clay as an additive or filler.

Well over 20 different raw materials are used to create a decorated Christmas tree. And what about the natural resources that go into the gifts, or the electricity to light the tree? WOW! AND, don't forget the steel saw used to cut down your Christmas tree!

Quiz

Listed below are some items often associated with a Christmas tree and some raw materials that are used to make these items. In the blanks write the letters of some of the raw materials used to make each item on the tree. Refer to the Key for some possible answers.

Christmas Tree Items

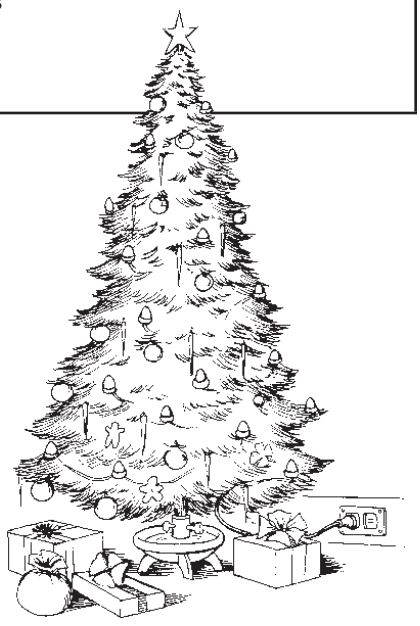
1. Star_____
2. Tree_____
3. Ornament hangers_____
4. Electrical wire_____
5. Light bulbs_____
6. Wire insulation_____
7. Ceramic ornaments_____
8. Plastic ornaments_____
9. Electricity_____
10. Glass ornaments_____
11. Paint_____
12. Tree stand_____

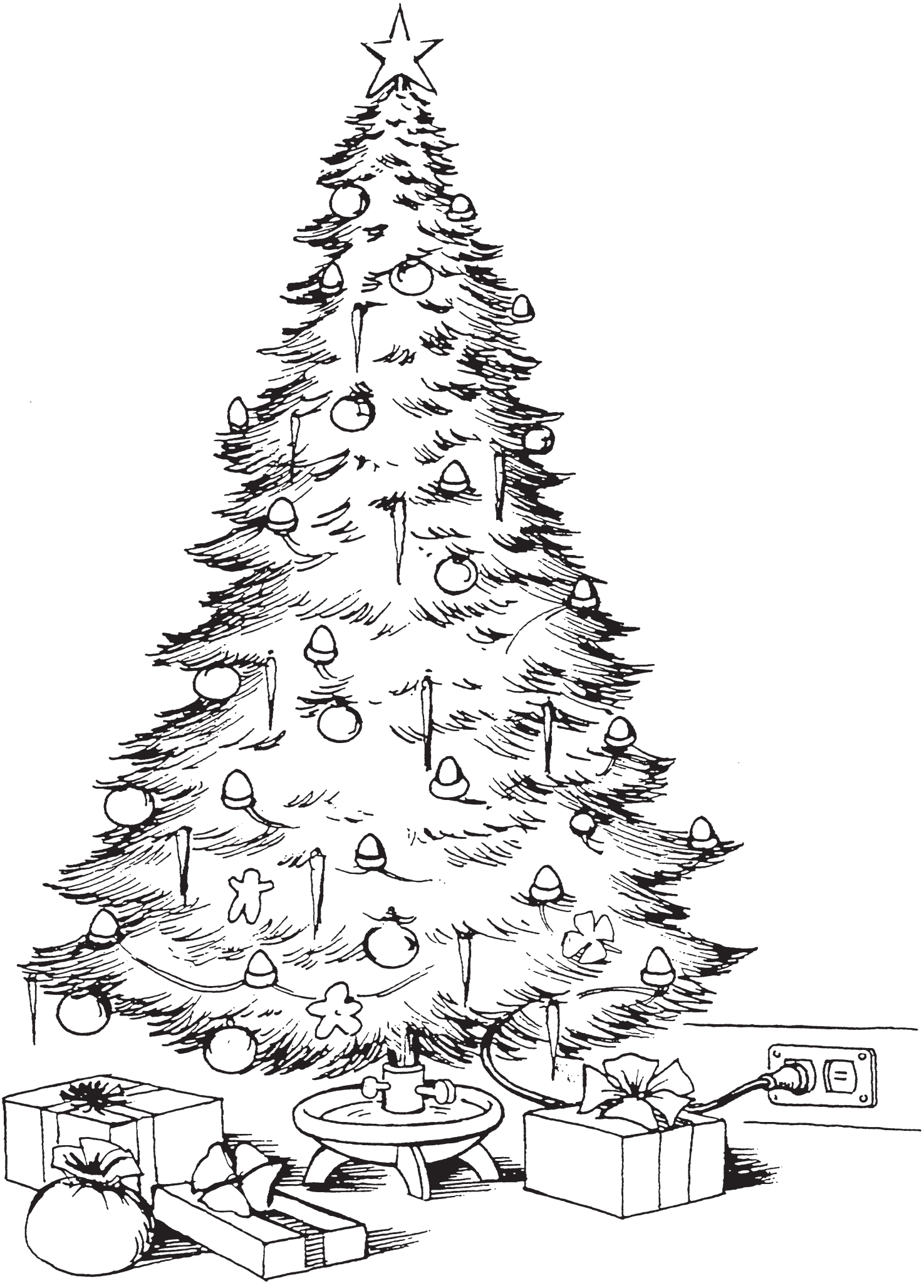
Raw Materials

a. Sulfur
b. Trona
c. Lead
d. Mica
e. Petrochemicals, oil, natural gas
f. Aluminum
g. Potash
h. Iron
i. Silica
j. Vermiculite
k. Clays
l. Silver
m. Manganese
n. Pumice
o. Nepheline syenite
p. Limestone
q. Copper
r. Phosphates
s. Lithium
t. Titanium
u. Rare-earth elements
v. Tungsten
w. Wood
x. Feldspar
y. Coal
z. Water

Key:

1. Star: f, l, q
2. Tree: a, g, r, w, z
3. Ornament hangers: f, h
4. Electrical wire: q
5. Light bulbs: x, i, k, o, b, v
6. Wire insulation: e, n, p, w, j, x, b
7. Ceramic ornaments: x, i, k, o, b, h, q, c
8. Plastic ornaments: e
9. Electricity: e, y, z
10. Glass ornaments: x, i, o, b, h, q, c
11. Paint: e, d, k, s, t, m, u
12. Tree stand: h, f, w





MAKE YOUR OWN PAPER MODEL OF A

This activity is intended to help students visualize a stratovolcano (inside and out) and to learn some of the terms used by geologists in describing it. By constructing and examining the model, students will obtain a greater appreciation of the relationship between the internal structure of the volcano and its exterior shape and features. This exercise may give the student an insight as to how a stratovolcano is formed.

Guide

The model represents a *stratovolcano*, or *composite volcano*. It is the most common type of volcano on Earth. Scientists classify volcanoes into three main types: cinder cones, shield volcanoes, and stratovolcanoes.

Cinder Cone

Cinder cones are the smallest and are formed largely by the piling up of *ash, cinders* and *rocks*, all of which are called *pyroclastic* ("fire-broken") material, that have been explosively erupted from the *vent* of the volcano. As the material falls back to the ground, it generally piles up to form a symmetrical, steep-sided cone around the vent. Sunset Crater in Arizona and Paricutin in Mexico are well-known examples of cinder cones.

Shield Volcano

Shield volcanoes are generally not explosive and are built by the accumulation of very fluid *lava* flows that spread out to produce a mountain with broad, gentle slopes. Shield volcanoes are the largest of all volcanoes, up to tens of kilometers across and thousands of meters high. Kilauea and Mauna Loa Volcanoes in Hawaii are classic examples of active shield volcanoes.

Stratovolcano

A *stratovolcano* is built of lava flows interlayered with pyroclastic material; scientists believe that the layering represents a history of alternating explosive and quiet eruptions. Young stratovolcanoes are typically steep sided and symmetrically cone shaped. There are several active stratovolcanoes in North America. Since 1980 Mount Saint Helens in Washington has become the most familiar. Other well known stratovolcanoes in the United States include Mount Rainier, Mount Shasta, M. Mazama (Crater Lake), and Redoubt Volcano in Alaska. Mount Fuji in Japan and Mount Vesuvius in Italy are other famous stratovolcanoes.

Questions for Further Study

1. Name some other stratovolcanoes and their locations around the world.
2. On the paper model, a small town has been built at the foot of the volcano. This is a common situation around the world. What are some of the problems or hazards the townspeople might have to face living so close to a volcano? Discuss possible solutions to these problems with your class.
3. What types of rocks are associated with each of the three types of volcanoes discussed above?
4. What is another word for the "hole", or vent, in the top of the volcano?
5. Where is the main vent of the paper model volcano? Can you find a second vent drawn on the side of the model volcano?
6. Why are most volcanoes on Earth cone-shaped?

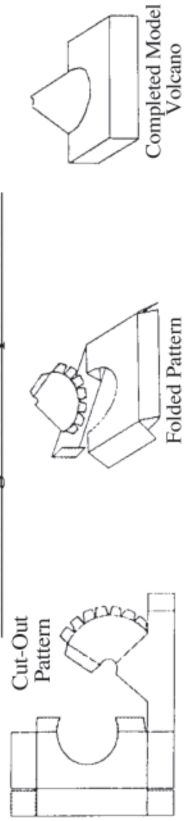
Vocabulary

ash	vent	cinder cone	stratovolcano	composite volcano	pyroclastic
lava	cinders	eruption	shield volcano	volcanic hazards	crater

Adapted from USGS Open File Report 91-115A by Tao Rho Alpha and Leslie C. Gordon

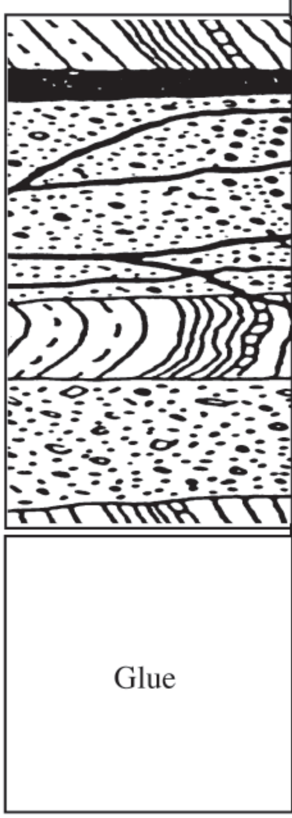
Volcano Pattern

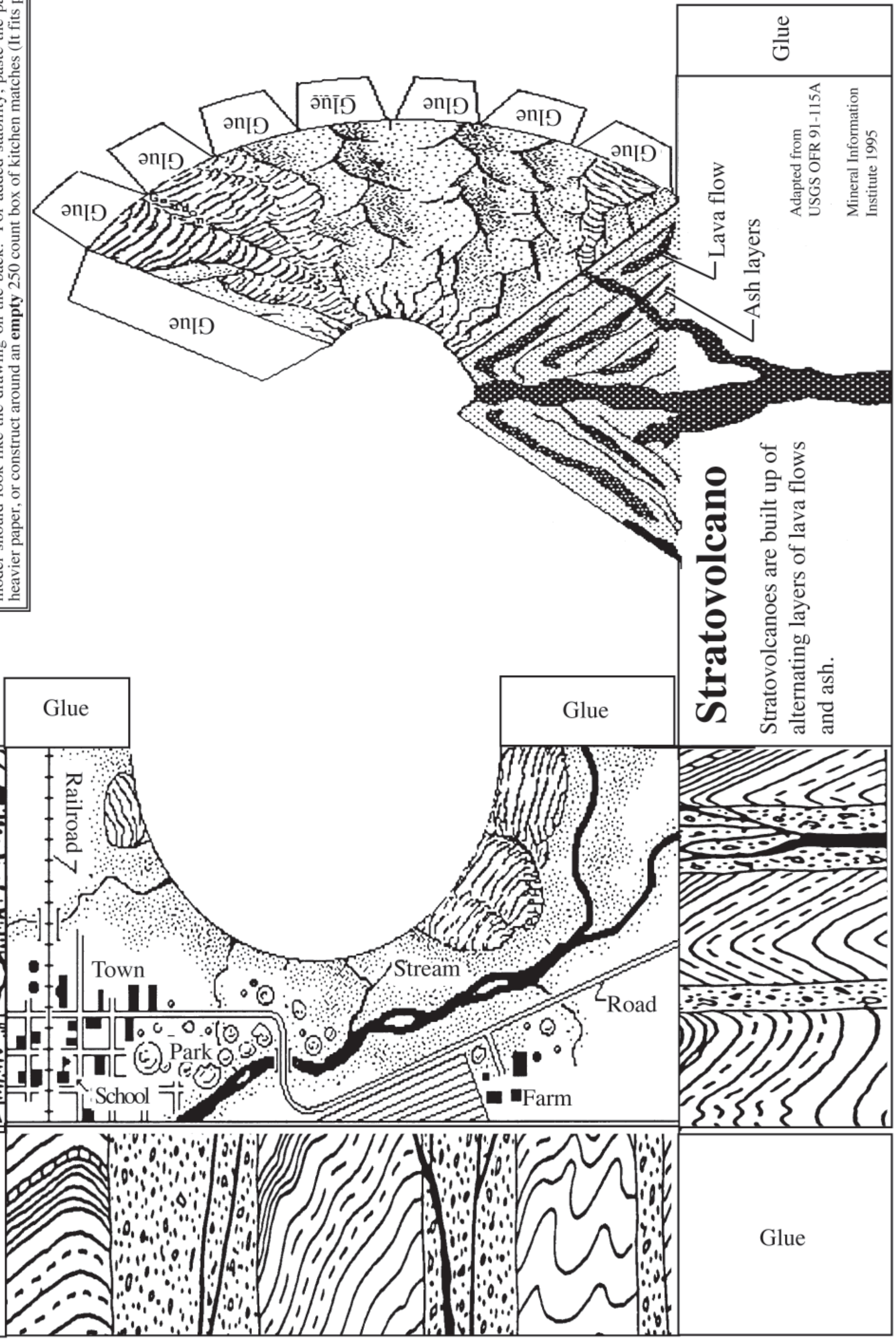
Constructing Your Paper Volcano



If you want to color the model, do so before you cut it out. Cut out the paper volcano model by cutting it along all its outside edges. Fold the pattern as shown in the diagrams above, so the printed side faces outward. Try the pieces for fit before applying glue or tape. Your completed model should look like the drawing on the back. For added stability, paste the pattern onto heavier paper, or construct around an **empty** 250 count box of kitchen matches (It fits perfectly!)

This formation represents the earth under your feet. ↓↓↓





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